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Patient Characteristics and Predictors of Mortality Associated With Pericardial Decompression Syndrome

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Abstract

Background

Pericardial decompression syndrome (PDS) is a rare and potentially fatal complication of apparently successful pericardiocentesis, characterized by paradoxical hemodynamic deterioration, ventricular dysfunction and pulmonary edema. We sought to elucidate epidemiology and clinical factors associated with mortality in PDS.

Methods

A systematic review of PDS reported in PubMed was performed. We collected baseline clinical variables, echocardiographic and hemodynamic variables, methods of drainage (needle versus surgical drainage), amount of fluid, and clinical outcomes. A case of PDS from our institution was added. T-test and Fisher's exact test were used for analysis of continuous and categorical variables, respectively.

Results

A total 34 cases (male 12, female 22) were identified. Needle pericardiocentesis, surgical drainage, or both were performed in 18, 15, and 1 patients, respectively. The procedure was done for cardiac tamponade in 32 cases. The mean age was 48 ± 17 . Large pericardial effusion was seen in 29 (85%) cases. Twenty patients (59%) had an underlying malignancy. Etiologies of effusion were malignant, infectious, traumatic, post-radiation, post-cardiotomy and unknown in 12 (35%), 3 (9%), 1 (4%), 1(4%), 1(4%) and 15 (44%) cases, respectively. Thirty cases reported the amount of effusion drained, and the mean amount was 902 ± 404 mL. The minimum drained effusion was 450 mL. The onset of PDS after the procedure varied widely, ranging from "immediate" to 48 hours. Cardiogenic pulmonary edema without shock, left ventricular (LV) failure only, right ventricular failure only, biventricular failure, and non cardiogenic pulmonary edema were seen in 9 (26%), 14 (41%), 3 (9%), 7 (20%), and 1 (4%) cases, respectively. Ten patients (29%) died of PDS. Mortality was seen only after surgical drainage and the association was statistically significant ($p < 0.001$). Severe LV dysfunction normalized in all PDS survivors. What led to the decision of needle pericardiocentesis versus surgical drainage in these patients is unknown.

Conclusion

PDS is a rare complication of pericardiocentesis with a high mortality rate. The minimum amount of drained effusion in our series was 450 mL. Surgical drainage was associated with mortality in PDS.

Background

- Pericardiocentesis is a needle-based procedure for drainage of pericardial effusion.
- It can be lifesaving in cardiac tamponade by promptly draining fluid from the pericardial space.
- Generally, immediate and dramatic hemodynamic improvement is expected when therapeutic pericardiocentesis is performed for cardiac tamponade.
- Pericardial decompression syndrome (PDS) is a rare and potentially life-threatening complication of apparently successful pericardiocentesis and surgical pericardial drainage.
- It is characterized by paradoxical hemodynamic deterioration, ventricular dysfunction and pulmonary edema.
- Since the first description in 1983 by Vandyke et al., only 33 cases have been reported in the literature, and it has been variably referred to as PDS, low cardiac output syndrome, and acute cardiovascular collapse.
- Presently, epidemiology, risk factors, prevention, and management of PDS are unknown.
- In this study, we sought to elucidate clinical factors associated with mortality in patients with PDS.

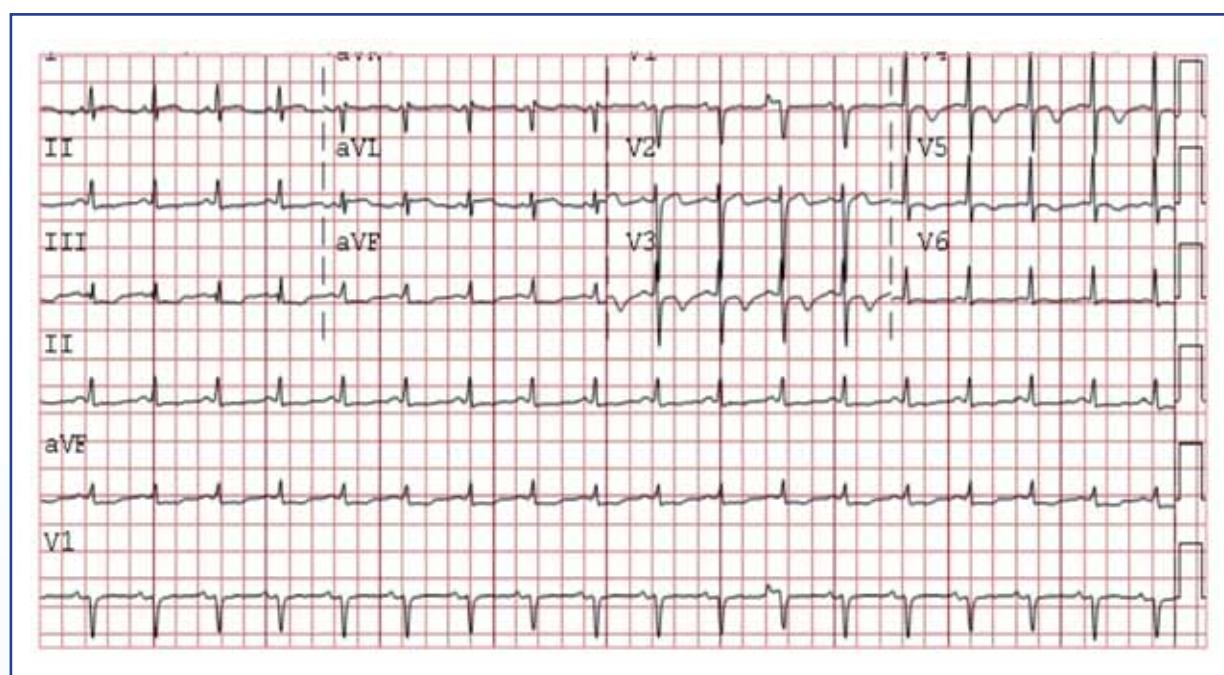
Methods

- A systematic review of all cases of PDS reported in PubMed was performed since the first reported case in 1983.
- All cases with abstracts available in English language were collected and reviewed.
- A case of PDS from Thomas Jefferson University Hospital (TJUH) was added and a total of 34 cases were analyzed.
- We collected baseline clinical variables, echocardiographic and hemodynamic variables, methods of drainage (needle versus surgical drainage), amount of fluid drained, and clinical outcomes.
- T-test and Fisher's exact test were used for analysis of continuous and categorical variables, respectively.

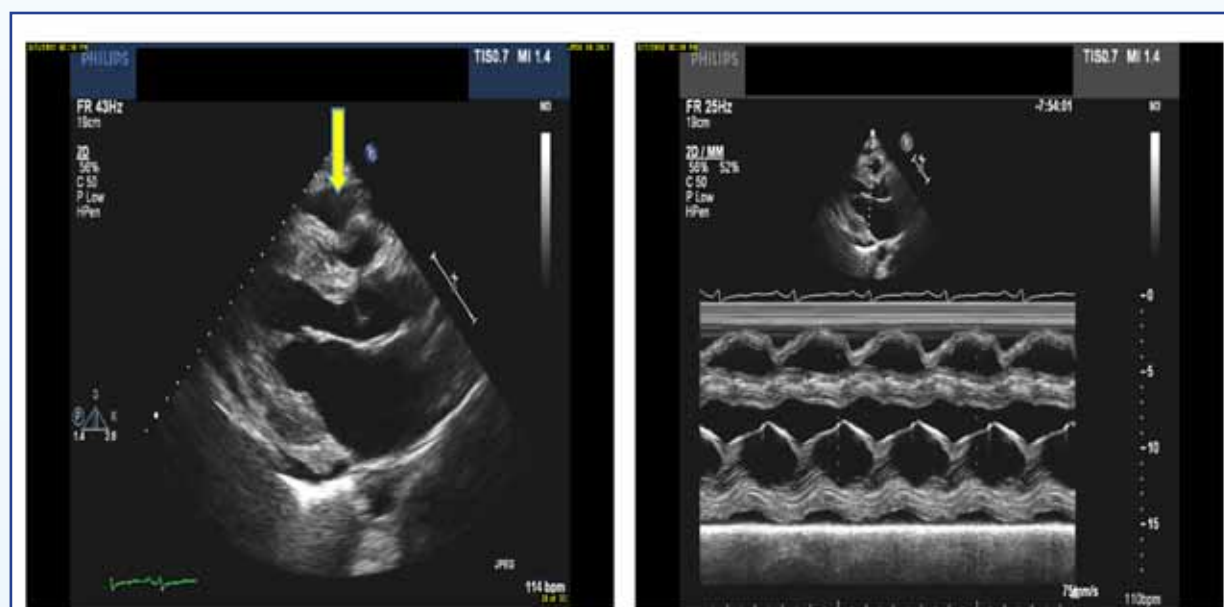
A case of PDS at TJUH

- A 41-year-old male with myelodysplastic syndrome with transformation into acute myeloid leukemia presented with sharp chest pain.
- Received multiple chemotherapies in the preceding year and was treated for pneumonia a month prior
- Heart rate 122 bpm, blood pressure 109/70 mm Hg, respiratory rate 22 per minute, pulsus paradoxus 2 mm Hg, flat neck veins, in respiratory distress
- ECG: sinus tachycardia, ST-segment depression in the inferior leads with diffuse precordial T wave inversion.
- CXR: enlarged cardiac silhouette and improved bilateral lung infiltrates compared to one month prior
- Non contrast CT scan of the chest: small to moderate pericardial effusion, larger compared to one month prior
- Troponin T was elevated at 0.9 ng/mL (normal <0.01 ng/mL).
- Echocardiogram revealed low normal left ventricular systolic function, small to moderate circumferential pericardial effusion with right atrial and ventricular collapse consistent with cardiac tamponade.
- Urgent echocardiography guided, needle pericardiocentesis and drain placement was performed: 550 mL of straw colored fluid.
- Immediate resolution of right ventricular collapse with minimal residual pericardial fluid seen adjacent to right atrium. Improvement in tachycardia.
- Within 30 minutes of the procedure, patient became hypotensive with systolic blood pressure to 70's mm Hg. Repeat ECG revealed worsening ST-segment depression in the inferior leads.
- Repeat echocardiogram showed new anterolateral and inferolateral wall hypokinesis, new right ventricular dysfunction and moderate to severe mitral regurgitation. There was no reaccumulation of pericardial effusion.
- Patient was treated with intravenous fluid boluses and taken emergently for left and right heart catheterization for further evaluation.

Presenting ECG



Circumferential pericardial effusion with right ventricular diastolic collapse



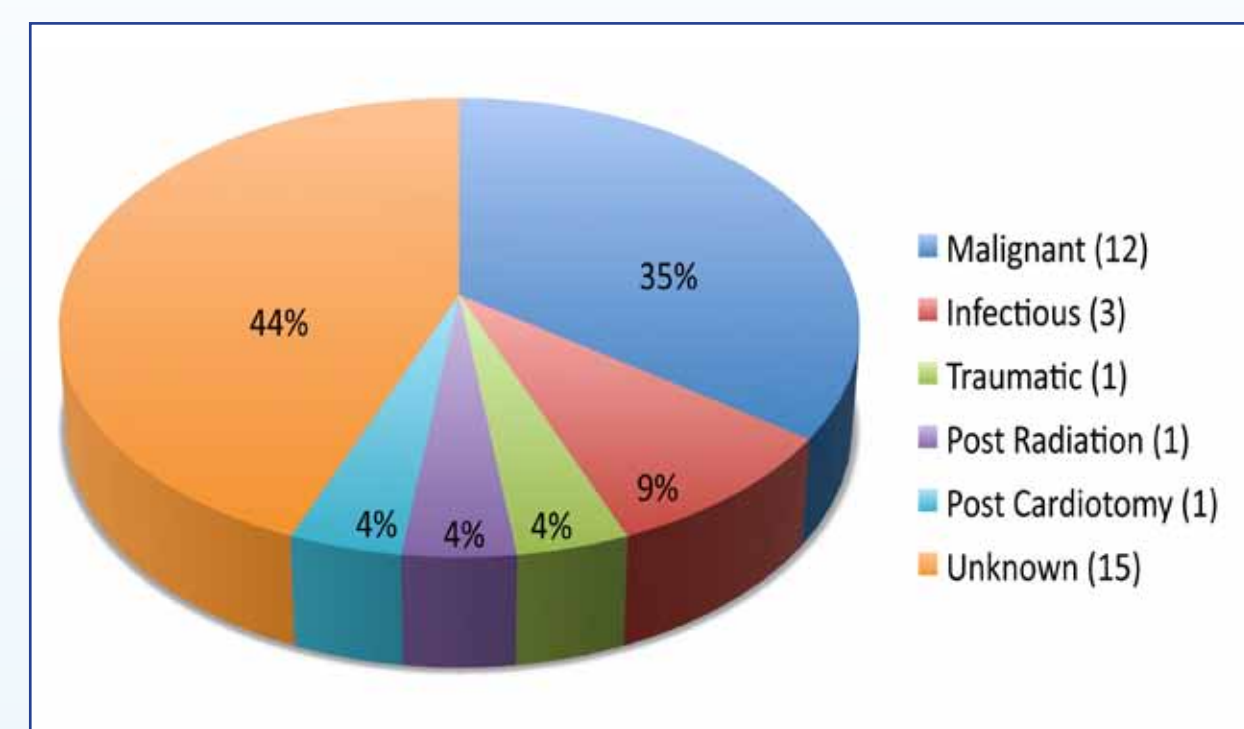
Still frame of parasternal long axis view in M-mode echocardiography showing RV diastolic collapse in parasternal long axis view arrow.

- Patient required intubation for respiratory failure due to pulmonary edema prior to cardiac catheterization.
- Coronary angiography revealed luminal irregularities.
- Right heart catheterization revealed elevated biventricular filling pressures with preserved cardiac output.
- Hemodynamics were as follows: right atrial pressure 21 mm Hg, pulmonary artery 50/31 mm Hg (mean 39), wedge pressure 36 mm Hg, cardiac output 6 L/min, cardiac index 3.1 L/min/m^2 , systemic vascular resistance $674 \text{ dyne-sec/cm}^5$.
- Admitted to Coronary Care Unit and managed supportively with intravenous vasopressors and diuretics.
- Vasopressors weaned off and patient extubated 2 days later and discharged home on hospital day 9.
- Repeat echocardiogram 2 weeks later showed normal biventricular function, mild mitral regurgitation and no recurrence of pericardial effusion.

Results

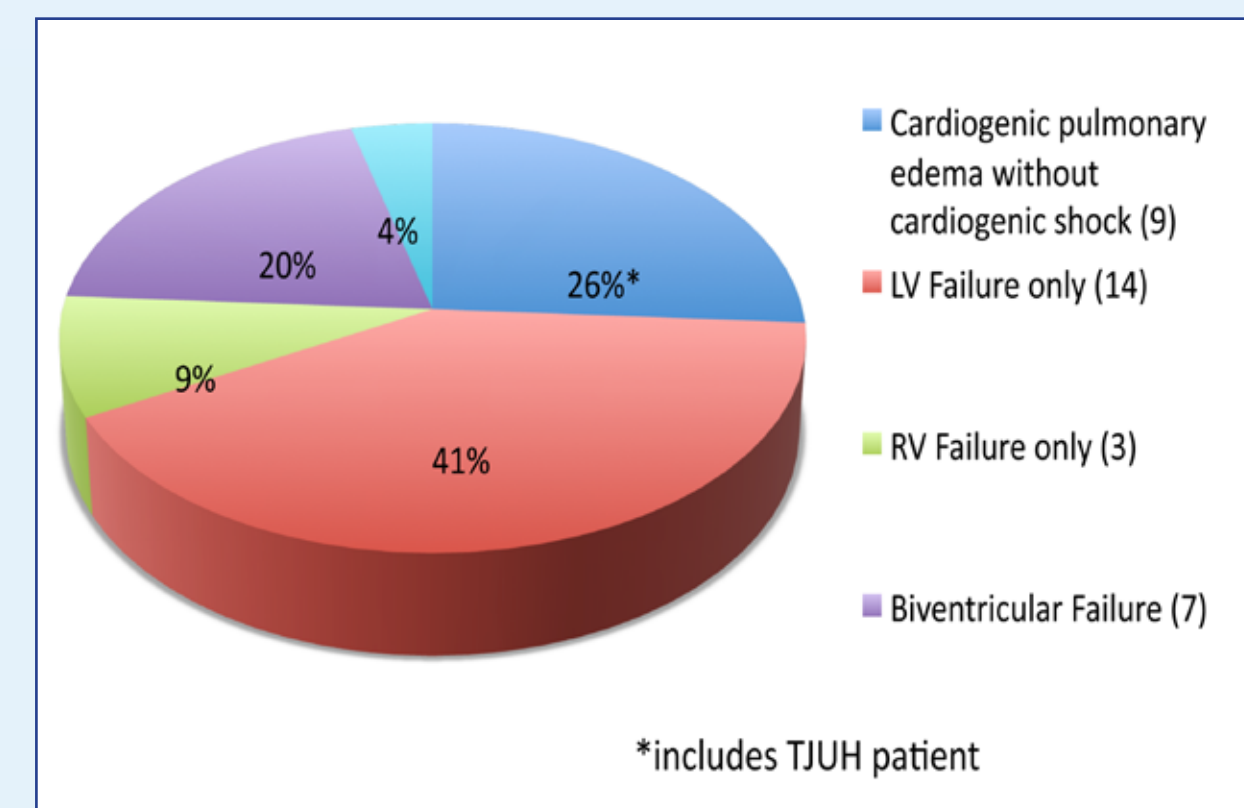
- 26 single case reports and 2 case series (consisting of 2 and 5 patients), were identified through a PubMed search.
- Needle pericardiocentesis was performed in 18 patients, while surgical drainage was performed in 15 patients. One patient underwent both.
- The procedure was performed for cardiac tamponade in 32 (94%) cases.
- There were 22 females and 12 males.
- Mean age was 48 ± 17 (mean \pm SD).
- Large effusion was seen in 29 (85%) cases.

Etiology of Pericardial Effusion



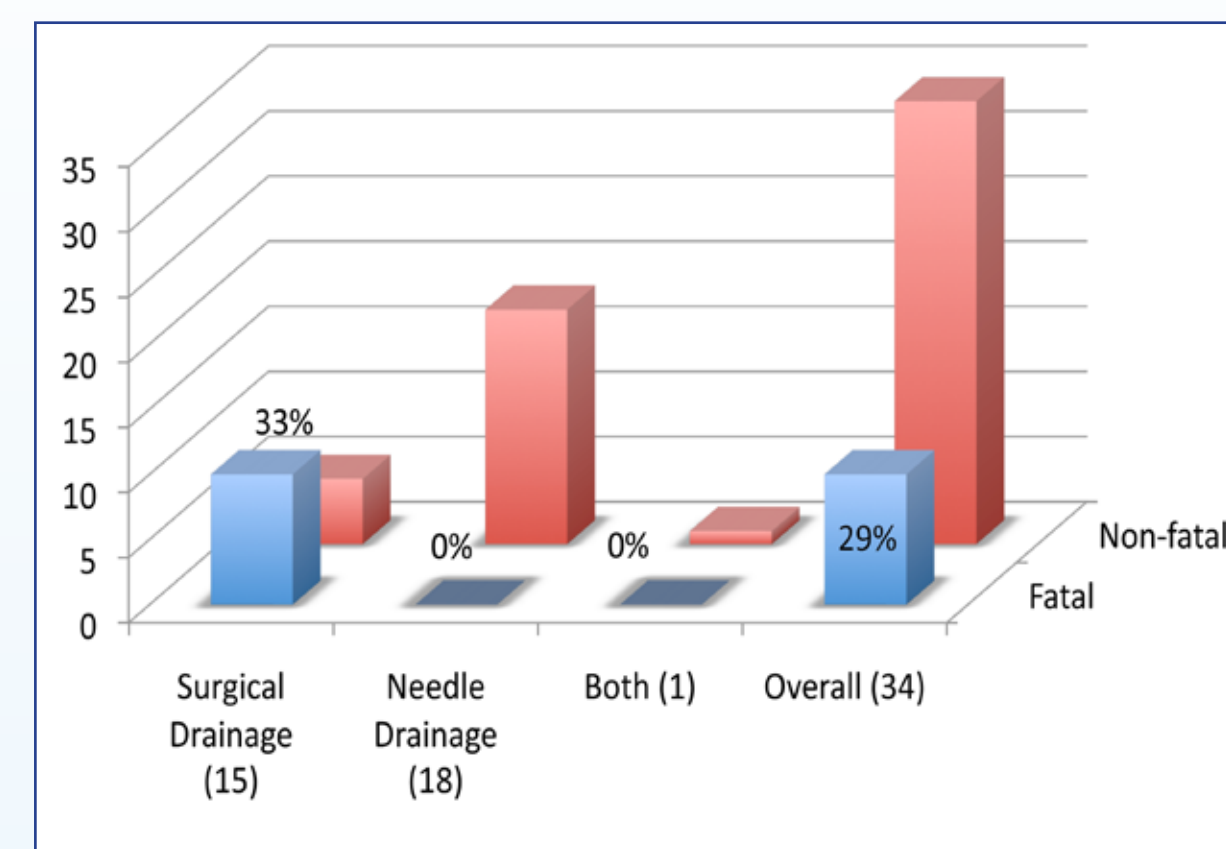
- 30 cases reported the amount of effusion drained. The mean amount was 902 ± 404 mL.
- Minimum amount of effusion drained was 450 mL.
- Onset of PDS varied widely ranging from 'immediate' to 48 hours.
- Cardiac biomarkers such as creatine kinase and troponin were obtained in 10 cases, and were found to be elevated in 8 cases.
- 6 patients underwent coronary angiography. There was no obstructive coronary artery disease to explain acute hemodynamic deterioration.

Manifestation of Pericardial Decompression Syndrome



- 15 patients had evidence of new severe left ventricular dysfunction associated with PDS.
- 11 of these had follow-up echocardiogram and all of them demonstrated complete normalization of left ventricular systolic function.
- 10 (29%) patients died of PDS.
- Surgical route of drainage was the only predictor of mortality associated with PDS ($p < 0.001$)

Association with mortality in PDS by route of drainage



Limitations

- This is a retrospective series of reported cases and has inherent biases related to such studies.
- The sample size is small secondary to low incidence of PDS.
- There is possible publication bias as milder cases may not have been reported, and hence the reported cases may not represent the overall patient population.
- The reported cases of PDS in our series may be a heterogeneous group of disorders due to lack of standard definition and diagnostic criteria for PDS.
- Decision for needle pericardiocentesis versus surgical drainage was unknown.

Conclusions

- PDS is a rare complication of pericardiocentesis with a high mortality rate.
- The minimum amount of drained effusion in our series was 450 mL.
- Surgical drainage was a predictor of mortality in PDS.

Disclosure Statement

All the authors have read and approved the content of this poster. None of the authors have potential conflicts of interest or a relationship with industry to disclose.